Examples of Costs and Methods for Controlling Mussels Affecting Drinking Water Infrastructure

Costs based on 2011 expenses for facilities ranging in size from 1 to 120 million gallons/day

- Annual O&M including chemical treatment and scraping ranged from $13,000/year to $400,000/year depending on facility size and magnitude of infestation
- Capital Costs (coating, feed lines, tanks, screens) ranged from $12,000 to $1.4 million depending on the infrastructure at risk and size of facility.
- Some facilities opt for routine O&M methods and no capital improvements. Infrastructure coated with mussel-settling repellant would reduce or eliminate the O&M cost of routine mussel removal.

Methods used in other states to mitigate mussel impacts to drinking water infrastructure:
Veligers are mussel larvae that can float through a system. These must eventually adhere to a hard surface to survive and mature.

Mechanical
Apply antifouling material and coatings to protect parts of the intake structure
Remove mussels from intake structures through scraping, oxygen deprivation and desiccation
Pig the interior of mussel-infested pipes by forcing a flexible plug through pipelines
For small diameters: manual cleaning by hydroblasting, abrasive blasting and wire brushing
Change screen material to copper, brass or nickel. Mussels avoid these surfaces.
0.04 millimeter mesh filters or sand filtration will screen out most veligers

Chemical
Apply to source water and within infrastructure
The chemical of choice depends on availability, cost, need for taste and odor control, need to avoid disinfection biproducts.
Some effective chemicals are: ozone, potassium permanganate, chlorine compounds

Management
Reduce hydraulic residence time in transmission pipe and pumps
Monitor for veligers and adults in source water and infrastructure
Public education about source water protection

At-Risk Drinking Water Infrastructure

System components at greatest risk of infestation are: intake structures and screens, pumps, small-diameter piping and valves, dead ends in the pipeline, areas with low water flow/velocity conditions or with stagnant water, and areas with abundant organic matter and oxygen

Types of facilities at highest risk draw from a lake or reservoir. Montana examples are:

- Conrad draws from Lake Frances
- Helena draws from Canyon Ferry via the Regulating Reservoir
- Whitefish has a standby intake from Whitefish lake
- North Central Montana Regional Water System will draw from Tiber Reservoir

Meet the Mussel

Aquatic invasive mussels of concern to Montana are the Zebra and Quagga mussels. These are almost identical in terms of their impact to drinking water infrastructure.

Invasive mussels can remain suspended in the water for 3 to 4 weeks before they find a hard surface to attach to; those that don't find a substrate to attach will die. Veligers (larval stage) are about 0.07 – 0.30 millimeters in size depending on stage of growth. Mussels can tolerate water temperatures from 32° F to 96° F. They need a flow rate less than 6 ft/s to attach and a temperature of at least 54°F to reproduce. Adults can survive out of water for 7 days and reach a maximum size of 50 millimeters

Veligers can be transported over considerable distances within a water treatment system before they settle, attach, and grow.

This fall, aquatic invasive mussel larvae has been detected in samples from Tiber Reservoir, Canyon Ferry Reservoir, the Milk River downstream of Nelson Reservoir and the Missouri River upstream of Townsend. Only Tiber Reservoir mussel samples have been verified upon resampling. Extensive sampling will begin again after melt off, spring 2017.

More Information about Montana's mussel research and control efforts:

http://musselresponse.mt.gov

Infrastructure Cost and Control Information summarized from
Costs for Controlling Dreissenid Mussels Affecting Drinking Water Infrastructure:Case Studies by Rajat K. Chapkraborti, Sharook Madon, and Jagjit Kaur; CH2M and San Diego State University Published August 2016 American Water Works Association